DECISION – MAKING PROCESS FOR AVIATION ENGINEER IN THE DIAGNOSIS OF HELICOPTER

MODEL DECYZYJNY DLA INŻYNIERA LOTNICZEGO W DIAGNOZOWANIU ŚMIGŁOWCA

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Abstract: This publication shows the issue of decision-making process for aviation engineer in the diagnosis of helicopter. Decision model influence on system of safety aviation activity connected with correct service and operating of aircraft. The system constructed according to model of decision loop helps to select essential information and analyze current technical state of helicopter, what allow on quick and efficient planning next technical activities. The decision loop is very good indication, which should be used by technical staff and pilots during maintenance and operation of aircraft.

Key words: maintenance, operation, diagnostic, management project, aircraft safe system.

Streszczenie: W publikacji przedstawiono istotę procesu decyzyjnego inżyniera lotniczego w diagnozowaniu śmigłowca dla bezpieczeństwa lotniczego oraz działalność związaną z prawidłowym obsługiwaniem i użytkowaniem statków powietrznych. Systemy diagnostyczny konstruowane wg pętli decyzyjnej pomagają selekcjonować istotne informacje, analizować aktualny stan techniczny śmigłowca, co pozwala na szybkie i skuteczne zaplanowanie racjonalnych, technicznych działań. Model-pętla decyzyjna stanowi bardzo dobry wskaźnik, jakim powinien się kierować personel lotniczy podczas eksploatacji statków powietrznych.

Słowa kluczowe: eksploatacja, diagnostyka, zarządzanie projektami, system bezpieczeństwa lotniczego.
1. Introduction

Regular helicopter maintenance to the manufacturer's schedules underpins the safety, reliable operation, enhanced flying pleasure and peace of mind of anyone flying aircraft. If repairs are necessary, having confidence in a convenient approved helicopter the repair facility is always reassuring. For helicopter operation, the industry standard for helicopter maintenance is the European Aviation Safety Agency (EASA) Part 145.

As a current or prospective owner, a hirer of self-fly helicopters, or someone planning to learn to fly rotary wing aircraft, approval to EASA Part 145 is the standard that they should insist on this aspect.

Helicopter maintenance ranges from minor checks to major overhauls after several thousand hours' operation. Examples of maintenance and servicing that your helicopter operator may offer could include the following:

- annual helicopter inspection / Annual Review Certificate (ARC),
- overhaul,
- defect rectification,
- routine servicing,
- lead acid battery capacity checks,
- magneto inspections,
- main and tail rotor balancing.

An experienced maintenance facility will be able to do helicopter servicing on a wide range of aircraft from manufacturers such as Bell Textron, Robinson, Hughes, Eurocopter and Enstrom (look for manufacturer's approved maintenance facility status).

As well as general capability, some service facilities develop a specialist for particular helicopter overhaul.

Helicopter maintenance involves more than just on-aircraft mechanical work. When choosing a maintenance facility, look for the following services:

- cost-effective fixed-price servicing,
- full hangar facilities,
- experienced, accurate helicopters maintenance record administration,
- comprehensive parts stock lists for fast component availability,
- exemplary Customer Service,
- luxury waiting facilities with complimentary refreshments and Wi-Fi (Wireless Fidelity).

Together with quality work on the aircraft, these services ensure a perfect maintenance experience, help keep helicopters flying and make sure that busy owners' time is used effectively.

In conclusion, regular maintenance, undertaken by skilled, experienced and highly qualified experts ensures that helicopter operators and flyers enjoy the following benefits:

- compliance with legal obligations during design,
– safety,
– peace of mind,
– reliable maintenance and reduced cost,
– pleasure.

The main subject concerning helicopters design does not only relate to stability and flight control (steering and balance) but also to problem of safety achievement by aviation engineer decision process. The evolution and advance in aviation design is stimulated by all virtual functions and helicopter systems (automation) involved in service control and complement function (human factors) originally performed by aviation engineer. The technical and human aspects provide an informative and readable overview of developments in the field of aviation projects with the theoretical advance (e.g. genetic heritage in analysis of intention for process decision) in order to support developing helicopters construction.

The upgraded effect aircraft design can be creation by correlation model between helicopter and decisional process of aviation engineers by integration using spheres of modern sciences (technique, economy, psychology, medicine etc.). This model provides to increase in managing process of aviation projects.

This model affects technical, medical science and economical aspect:
– safety and security of flights,
– reliability of aviation,
– biomechanical factors of aviation engineer,
– maintenance aircraft within economics.

The aviation design process generally focuses on interface between aviation engineer and helicopter. Moreover, the aviation engineer – helicopter system performances also reflects with its other components (e.g. turbine engines, main rotor and tail rotor, drive system, navigation systems, air conditioning, fuel and oil installation etc.) the following factors:
– technical - parameters requirements,
– environmental constraints,
– maintenance and service of helicopter,
– aviation equipment,
– training of technical staff (e.g. simulator of service procedure).

The consideration the above mentioned issue, the aviation engineer factors influence on helicopters design by model correlation helicopter survivability and decision process. This aspect is covered as well as development of aircraft project management.

2. The aviation engineer – helicopter system

The aviation engineer – helicopter system analysis, in terms of physical condition with technical aspect (e.g. ergonomics) in periods of interactive factors. This system presents how the aviation engineer detects a technical signal from helicopter. The helicopter accident by type of operations from 1990 till 2000 (fig.1) regarding with maintenance by aviation engineer.
Fig. 1  The helicopter accident by type of operations - human factors
Accidents that kill helicopter pilots by Darren Smith, CFII
http://www.cami.jecbi.gov/AAM-600/610/600Air-HFB.html

Over the past 40 years, over 80% of accidents and incidents were related to the human element and were largely preventable through the proper application of human factors principles. If the accident or incident rate is to be decreased, human factors must be better understood and the knowledge more broadly applied. That is why the aviation engineer should give himself question: are you fit to maintenance? and answer I’M SAFE.

I - ILLNES: Do you have any symptoms?
M - MEDICATION: Does your family doctor know you are a pilot and an technical staff?
S - STRESS: Are you upset after a quarrel?
A - ALCOHOL or DRUGS: Are you influenced by anything that will impair your judgement?
F - FATIGUE: Have you had sufficient rest?
E - EATING: Do you have sensible eating habits?

It is a very important in decision process applicable to a new understanding (awareness) of correct response time (decision time) in various digital or analogue panel (ergonomics cockpit aspect) and drive system of helicopter. As well as focusing on capabilities analytic system there should be relation to another step in decision process during service of helicopter.

This aviation engineer – helicopter system should consider essential components:
- the physical stimulus,
- cognitive activities (behaviour, habits, reactions etc.),
- responses of aviation engineer.
Thus the human factors and mechanical interactions create together. The physical variable (aviation engineer stimulus) within maintenance of helicopter must be in relations at the same time. The human factors is the scientific discipline concerned with the understanding of interactions among humans (e.g. aviation engineer) and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

That is why aviation engineer is one of the components which can be supported by modeling system for analysis and prognosis technical state of helicopter. The human has various senses (sights, sounds, smells, touch) which allow to pick up signals from the instrument diagnostic panel (displays) and from the surrounding of the helicopters (fig.2). That is why the aviation engineer has to make a good decision by different senses. This model recognizes specific cognitive functions of aviation engineer’s brain memory for realization air tasks.

The aviation engineer – helicopter system is relevant correctness method to solve of detection the failure which should be taken in helicopter design. These systems must consist of following elements:

- various essential signals at nearby source of the failure (diagnostically system),
- the faire signal’s effects of electromechanical components to the attention of the aviation engineer’s individual senses (predisposition),
- the aviation engineer’s memory for various types of systems,
- the aviation engineer’s criteria for possibility and capability of training habits, behaviors and reaction in simulators of maintenance procedure.

The aviation engineer – helicopter system with detection failure would make probability of various signals (noise, smog, too high oil pressure or temperature etc.) by different symptoms from turbine engines, installations and additional equipment functioning. This system shows also aspect concerning ergonomics modeling, techniques and most of them, software computer-based simulation.

Moreover, this system as decision perspective would be based upon of helicopter survivability and intention analysis by human factors loop.

The design of quality management process of helicopter production is the same as other products, however the quality level has to be higher.

The helicopter production system should be initialed by restrict simple control procedure loop (fig.3) as well as previous experiences during aircraft piloting (steering and stability). The model of helicopter production consists of the following aspects:

- realization of project,
- analysis of intention (human factors),
- manufacture of helicopter,
- quality controlling, test, inventory and delivery,
- financing,
- research aviation development,
- aviation market research.
The production decision represents management’s decision to produce essential elements of helicopter in response to research development by manufacturing process itself.

It is followed by quality controlling test, certification, inventory and delivery which unfortunately creates the same time lag. The helicopter has to be checked by controlling and monitoring operationally regard into in the production decision. This production decision is directed not only company orders but also in aviation market research (e.g. TQM- Total Quality Management). The production should be stopped when the external financing inputs in borrowing money for the helicopter delivery.

The output of finance drives two ways for:
- paying for decision connected with production of helicopter,
- financing research aviation development.

Fig. 2 The aviation engineer - helicopter system [1]
Moreover, the output of research aviation development is important to aviation market research. It provides predicting (prognostics) new orders and new goals for effects in order to possibility helicopter production (manufacture). A good level checked of the helicopter production will be quality relevant tests in order to be sent back for rework and so on. This system model of the helicopter production is one of tools supporting design manufacturing process. The criteria of success in aviation design is using the system human-helicopter perspective applicable to modelling, analyzing, interactions (process decision loop) and quality management system for safety flight. This is a very important to achieve airworthiness of helicopter.

3. Model of aviation engineer decision

Philosophy of decisional model within a new technology offers the best solution for safety and efficient aircraft flight. The human factors loop correlation with technology. There are relating to upgrade air equipments already existing on recent knowledge aviation program (e.g. maintenance and operation). Constantly, the knowledge and experiences used in system design provide interpretation of aviation engineer’s behaviors (fig.4). Over all, aviation project management should concerns model of decision loop which is allowing:
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- large growth in potential of leading aviation projects,
- progressive involvement of helicopter,
- budgetary constraint and strategy choices,
- integration of equipment selected by technical staff,
- industrial expertise for real and no risk aviation program,
- federate training, maintenance and workmanship of helicopter in the future.

Above all this model will be able to make facility integration of air business in
common logistic process.

Keeping in mind safety flight and security maintenance, the decision model of
aviation engineer supports activities of technical staff in service process Moreover
model of decision describes their physical condition factors (e.g. genetic heritage)
in the aim to take the rapid but correct decision for enables fulfillment task.

All components of this model relate to: requirements, analysis of intention,
decisions and activities with habits, behaviors and reaction which is showing loop.
The requirements applicable to collection of norms „conditions”. The technical
staff has to adapt himself into unpredictable circumstances during flight.

![Model of aviation engineer decision loop](image)

**Fig. 4 Model of aviation engineer decision loop [1]**
The analysis of intentions related to inspection of correctness reasoning e.g. genetic heritage, cultural conditions, experience and intellectual developments for activity service. The decision is final condition of definite activities realization. Another aspect is the team’s activity which is undertaken for successes in definite target. There is also reversible information as return message about pronouncement of events for being recognition between decision with activities and requirements within analysis of aviation engineer intention. Moreover, this decisional loop is a mutually related process of forecasting ways of behavior in definite situation.

4. Conclusion

In conclusion, the model of aviation engineer decision for maintenance of helicopter should be based upon certain assumptions:

1) Contemporary development of physiological characteristic allow to create approach system for defining of safe helicopter by the decision loop of aviation engineer.
2) The proper level of helicopter’s design is created by correct decision which affects on good service for safety flight.
3) New system influences on quality of executed development service of technology and knowledge enriching for aviation project management.

1. Literature

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